10/13/16

"The biggest human temptation is to settle for too little" -Thomas Merton

HW: "Product and Quotient Rules HW" #1-4, 17, 19

Test 2 on Wednesday 10/19

AIM: What is the Product Rule?

Warm Up:

Differentiate (find the derivative) the following:

$f(x)= (x+2)(x-3)$

$f(x) = x^2 - x - 6$

$\boxed{f'(x) = 2x - 1}$

Product and Quotient Rules

If a function contains two variable expressions multiplied together, you can't simply find the derivative of each and multiply the results.

$$y = (3x^2 - 5x)(x^4 + 3x^2 - 9x + 1)$$

$$y = 3x^6 + 9x^4 - 27x^3 + 3x^2 - 5x^5 - 15x^3 + 45x^2 - 5x$$

$$y = 3x^6 - 5x^5 + 9x^4 - 42x^3 + 48x^2 - 5x$$

$$\boxed{y' = 18x^5 - 25x^4 + 36x^3 - 126x^2 + 96x - 5}$$

$$\boxed{y' = (3x^2 - 5x)(4x^3 + 6x - 9) + (x^4 + 3x^2 - 9x + 1)(6x - 5)}$$

1. **The Product Rule:**

If a function is the product of two differentiable functions then the derivative is “the first times the derivative of the second plus the second times the derivative of the first.”

$$\frac{d}{dx}\left[f(x) \cdot g(x)\right] = f(x)g'(x) + g(x)f'(x)$$

Shorthand

$$h = f \cdot g$$

$$h' = f \cdot g' + g \cdot f'$$

EX #1: Find the derivative of $f(x)$

$$f(x) = \underbrace{(2x-1)}_{g(x)}\underbrace{(x-4)}_{h(x)}$$

$f(x) = 2x^2 - 8x - 1x + 4$
$= 2x^2 - 9x + 4$

$f'(x) = g(x) \cdot h'(x) + h(x) \cdot g'(x)$

$$\boxed{f'(x) = (2x-1)(1) + (x-4)(2)}$$

$f'(x) = (2x-1) + (2x-8)$

$f'(x) = 4x - 9$

EX #2: Differentiate

$$y = \underbrace{(x^2 + 3x - 1)}_{f}\underbrace{(2x^2 - 5)}_{g}$$

$$y' = f \bullet g' + g \bullet f'$$

$$\boxed{y' = (x^2+3x-1)(4x) + (2x^2-5)(2x+3)}$$

HW:)

Recall:

$\sin x \rightarrow \cos x$

$\cos x \rightarrow -\sin x$

function $\rightarrow$ Derivative

3) $f(x) = x^4 \sin(x)$

$$\boxed{f'(x) = x^4(\cos x) + (\sin x)(4x^3)}$$

19) $f(\theta) = \boxed{\theta}\,\boxed{\cos\theta}$

$$f'(\theta) = \theta(-\sin\theta) + (\cos\theta)(1)$$

$$f'\left(\tfrac{\pi}{2}\right) = \tfrac{\pi}{2}\left(-\sin\tfrac{\pi}{2}\right) + \left(\cos\tfrac{\pi}{2}\right)$$

$$= \tfrac{\pi}{2}(-1) + 0$$

$$= -\tfrac{\pi}{2}$$

Horizontal Tangent Line occurs when the derivative is equal to zero.

Once you find the x-values plug them into original function to find the y-values.